CHAPTER FIVE

THE STATE OF TRANSPORTATION STATISTICS

CONGRESS CREATED THE BUREAU OF TRANSPORTATION STATISTICS (BTS) TO ESTABLISH A POLICY-RELEVANT KNOWLEDGE BASE FOR DECISIONMAKERS, AND TO INFORM THE PUBLIC ABOUT TRANSPORTATION AND ITS CONSEQUENCES. IN CALLING ON BTS TO REPORT ANNUALLY ON THE STATE OF THE TRANSPORTATION SYSTEM, CONGRESS ORDERED BTS TO PROVIDE "DOCUMENTATION OF THE methods used to obtain and ensure the quality of the statistics presented in the report, and recommendations for improving transportation statistical information." In response, BTS first examined ways to identify needed improvements to the transportation knowledge base. *Transportation Statistics Annual Report 1994* highlighted the needs expressed in congressional mandates, reports of the National Academy of Sciences, and initial customer responses to BTS products. In 1995, BTS published a comprehensive strategy of data-collection and analysis activities for meeting the initial set of needs. In this 1996 edition, BTS reviews the information needs identified to date and the progress made toward meeting those needs.

BTS and its partners are working on a wide range of data-collection, analysis, and dissemination activities to help answer the many questions of decisionmakers.

What We Need To Know About Transportation

BTS seeks to create a knowledge base that serves decisionmakers throughout the transportation community, including federal, state, and local governments, private industry, and quasi-public institutions. Components of the knowledge base are defined by:

- Congressional mandates for specific information, which are summarized in table 5-1;
- Comprehensive assessments in which information needs and resources are cataloged, gaps between the needs and resources are identified, and strategies for filling the gaps are proposed. (See, for example, USDOT (1969) and TRB (1992)); and
- Customer responses to BTS products.

► Extent and Use of the Transportation System

There must be a common understanding of what the transportation system comprises and how the system is used before decisionmakers' questions about the performance or consequences of transportation can be answered. How widespread are transportation facilities? How frequent are transportation services? How are these facilities and services interconnected? How many vehicles go how far? How many people and how much freight move over the system? How are these movements distributed by mode, in time, and geographically? There is no one answer to these questions. The answers vary by mode and intermodal combination, the geography and temporal aspects of travel and goods movement, and the characteristics of the traveler or shipment.

Modal distinctions are very important in transportation because the system is ultimately

TABLE 5-1: MANDATED TOPICS FOR DATA COLLECTION AND ANALYSIS

Topic	Source
Technological, statistical, economic, and other information relevant to domestic and international transportation	DOT Sec. 4a (49 USC 301(4))
Intermodal passenger volume and geography of intermodal flows	ISTEA Sec. 5002 (49 USC 301 note)
Intermodal freight volume and geography of intermodal flows	ISTEA Sec. 5002 (49 USC 301 note)
Air carrier passenger volume and geography of air passenger flows	FAA Sec. 311 (49 USC 329(b))
Public and private investment in intermodal transportation facilities and services	ISTEA Sec. 5002 (49 USC 301 note)
Motor carrier financial, operating, and safety conditions	ICC Sec. 103 (49 USC 14123)
Productivity in various parts of the transportation sector	ISTEA Sec. 6006 (49 USC 111)
Traffic flows	ISTEA Sec. 6006 (49 USC 111)
Travel times	ISTEA Sec. 6006 (49 USC 111)
Vehicle weights	ISTEA Sec. 6006 (49 USC 111)
Variables influencing travel behavior, including choice of transportation mode	ISTEA Sec. 6006 (49 USC 111)
Travel costs of intracity commuting and intercity trips	ISTEA Sec. 6006 (49 USC 111)
Availability of mass transit and the number of passengers served by each mass transit authority	ISTEA Sec. 6006 (49 USC 111)
Frequency of vehicle and transportation facility repairs and other interruptions of transportation service	ISTEA Sec. 6006 (49 USC 111)
Accidents	ISTEA Sec. 6006 (49 USC 111)
Collateral damage to the human and natural environment	ISTEA Sec. 6006 (49 USC 111)
Condition of the transportation system	ISTEA Sec. 6006 (49 USC 111)

SOURCES: DOT = Department of Transportation Act of 1966 (Public Law 89-670); FAA = Federal Aviation Administration Act of 1958 (Public Law 85-726); ICC = Interstate Commerce Commission Termination Act of 1995 (Public Law 104-88); ISTEA = Intermodal Surface Transportation Efficiency Act of 1991 (Public Law 102-240).

made up of motor vehicles, airplanes, and other transportation equipment carrying people and goods over roads, rails, and waterways, through the air, and, in the case of some goods, through pipelines. These components have very different physical and economic characteristics that must be understood before the integration of these components into an intermodal transportation system can be contemplated.

Geographic and temporal variation are important in the transportation equation. Transportation exists because economic and social activities are spread across the land. The distribution of population and economic activity provides the basic demand for transportation facilities and services. The perennial transportation problem—congestion—derives from too many people wanting to arrive at or depart from the same place at the same time.

The characteristics of freight being shipped and travelers are also important. Knowledge about who uses the transportation system is a prerequisite to understanding why demand for transportation facilities and services is evolving, what markets exist for new facilities and services, and who directly benefits from changes in the transportation system. Knowledge of trip purposes, which place very different demands on the system, is also of concern: speed and reliability considerations are very different for emergency medical transport, the routine daily trip to work or school, and discretionary weekend travel. Different types of cargo also place diverse demands on the system. For example, carbon in the form of coal moves in trainloads and shiploads; in the form of diamonds, it moves in briefcases on airplanes and in cars.

The combination of modal distinctions, temporal and geographic variation, and traveler and shipment characteristics means that a great amount of data is required to understand the extent and use of transportation. In most other fields, relatively small samples are sufficient to measure activity. Geographic variation is often adequately represented by sampling from each of the 50 states. In transportation, the flows of people and goods within and among the states require a sample large enough to fill a matrix of 2,500 cells (50 states of origin by 50 states of destination). This is why BTS-sponsored data collections such as the American Travel Survey (ATS) and the Commodity Flow Survey (CFS) are among the largest components of the Economic Census.

► Condition and Performance of the Transportation System

The transportation system's ability to serve travelers and shippers can be measured in physical terms, economic terms, and in terms of unintended consequences. Physical terms refer to two key questions: Does the system get people where they want to go, when they want to get there? How well does the delivery system for goods work? Specifically:

- Do the transportation facilities and services cover existing and anticipated origins and destinations? Quite simply, can you get there from here? How direct or circuitous is the route?
- Does the transportation system have enough facilities, vehicles, and services to serve demand? Is there enough capacity to handle predictable surges in demand, such as holiday travel? Is there enough capacity to handle unexpected surges in demand, such as responses to military threats overseas or natural disasters at home?
- How timely and reliable is the transportation system?
- How comfortable is the trip?

These questions reflect a user perspective rather than the traditional view of a transportation service provider, reflecting the contemporary realization that customer satisfaction is essential to continued survival of both public and private enterprises.

► Economic Dimensions of Transportation

Transportation is both a major consumer and an enabler of economic activity. To understand both aspects, it is important to ask:

- What proportion of the national economy does transportation comprise? How has that proportion changed over time?
- How much do transportation providers spend on material and other inputs from each sector of the economy? How has the quality of transportation service delivered per dollar spent changed over time?
- How important is transportation as a source of employment? What kinds of skills are needed in the transportation sector? How has the quality of transportation service delivered per hour or dollar of labor changed over time? What are the sources of changes in productivity of transportation workers?
- How much does each sector of the economy spend on transportation? How do these expenditures vary over time and by region? How much does transportation contribute to the total cost of a commodity or service? Is transportation being substituted for other costs of production, such as warehousing? To what extent do the availability and cost of transportation affect the labor force?
- How much does each level of government spend on transportation? How much do government expenditures reduce transportation costs for businesses and households? How much do government-supported transportation facilities and services contribute to economic output overall, economic growth, and international competitiveness?

The financial condition of transportation service providers is also relevant. Even in a largely deregulated environment, the financial health of a service provider affects that provider's ability to maintain and improve safety, meet contractual obligations to customers, and purchase more efficient or effective equipment. Financial health is not limited to carriers; for instance, the financial viability of private toll road authorities has become a recent concern.

► Unintended Consequences of Transportation: Safety, Energy Use, and the Environment

Most of the preceding questions involve the intended consequences of transportation: to support economic and social interaction at a minimum financial cost. More hotly debated areas involve transportation's unintended consequences for safety, energy use, and the environment.

- How likely are travelers or bystanders to be harmed or killed in an accident? How does the risk vary by type of trip, mode of travel, type of facility, season, or time of day?
- How likely are shipments or luggage to be damaged, lost, or stolen?
- How much energy is consumed overall and by different modes of transportation? What types of energy are being consumed? How much of that energy is from foreign sources?
- How much damage is done to air quality? How much damage is done to water quality? How much noise and other pollution are created?
- To what extent are wetlands and other sensitive human and natural environments disrupted by transportation facilities and activities?
- What are the economic costs of accidents and environmental damage? Are these costs reflected in the prices paid for transportation?

Can We Answer the Questions of Decisionmakers?

To answer the questions raised by decisionmakers about transportation, it is necessary to turn a question into a measurable concept, fill the

measure with data, and use models for conditions that cannot be measured directly or that need to be forecast. The ability to produce credible and timely answers to a question varies significantly by topic, mode, and geographic detail.

► Extent and Use of the Transportation System

Prior to passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991, the national picture of the transportation system was limited to very coarse, mode-specific maps of facilities and estimates of total vehicle activity by type of vehicle. An integrated, geographically detailed picture of transportation facilities and activity across all modes had not been compiled since the mid-1970s.

Since 1991, BTS has compiled a fairly extensive picture of the components of the transportation system and where they are located. The transportation community is just now beginning to understand how and where the transportation system is used. The state of this knowledge can be divided into four basic layers of information: facilities, services, flows, and context.

- *Facilities data* include the location, connectivity, and use of highways, railroads, airports and air space, ports and waterways, and pipelines. Good data are available on the location and connectivity for about 10 percent of the nation's highways, covering the Interstates and other major roads, most railroads, all rail transit facilities, all public use airports, and ports and all navigable waterways. Facility-specific use data are available for railroads, ports and waterways, airports, and a sample of highways. Data on the use of specific railroad segments can be estimated. The location of truck and rail terminals are known, primarily for those identified by states when defining intermodal connector roads to the National Highway System, but little is known about the use of those facilities. There is only very coarse information about the location, connectivity, and use of pipelines.
- *Services data* include the geographic domains of carriers and the amount and type of service provided within those domains. Data on where commercial airlines and long-distance water carriers operate and what service they provide are available. The ownership and trackage rights of railroads for each part of the rail network are known, but relatively little is known about the levels of service provided on each segment. The Department of Transportation is just now beginning to plot the location of public transit and intercity bus service. Geographic knowledge of truck and intercity bus operations is very limited, and pipeline data are available at best for multistate regions.
- *Flows data* include freight, passenger, and vehicle movements. The CFS covers most domestic freight activity, but must be supplemented by additional information on international, farm, and government shipments to obtain a complete picture. The surface transborder part of information on international movements is provided by BTS through the Census and Customs Bureaus. The ATS will provide information on long-distance passenger flows of U.S. households, but will also require supplements to identify the domestic travel of foreign visitors. Commercial aircraft and ship movements are tracked in great detail, but very little is known about the origin-destination patterns of motor vehicles.
- *Context data* establish the geographic context in which transportation exists including: political boundaries and other major features that help to physically locate transportation; the distribution of population and economic activity that generate transportation activity; and the distribution of environmental conditions and human activity affected by trans-

portation. Much of the population and economic context is provided by the Decennial Census of Population and Housing, which collects a wealth of demographic and economic characteristics of residents at a neighborhood scale. Since the decennial census long form includes questions on place of work, demographic and economic characteristics of workers at their place of work can also be mapped at the neighborhood scale. This provides the only nationwide source of information on economic activity below the county level. Extensive data on land uses and environmental conditions are available at the local level, but are not always comparable from one locality to the next. Definitions of some environmental conditions, such as wetlands, are the subject of extensive debate at both national and local levels.

There are both individual gaps in geographic information on the extent and use of transportation and a lack of consensus on the number of motor vehicles operated in the United States and the distance those vehicles operate. Most commonly cited motor vehicle statistics on the number of vehicles and how far they travel are provided by the states to the Federal Highway Administration and published in *Highway Statistics*. The National Highway Traffic Safety Administration uses alternate numbers from R.L. Polk, Inc. (USDOT NHTSA 1995) The Bureau of the Census also used R.L. Polk data for the Truck Inventory and Use Survey (TIUS). Accurate counts of vehicles by type of vehicle and valid estimates of their travel are essential for understanding changes in travel, accident rates and safety risks, fuel consumption rates, tax burden, and air pollution emissions and other environmental concerns.

► Condition and Performance of the Transportation System

The federal government has produced many reports on the condition and performance of highways, public transit, aviation, and waterways. Certain aspects of system performance, such as on-time statistics for airlines, are available with great geographic and carrier specificity. Extensive work needs to be done, however, to develop effective measures of mobility, accessibility, and congestion.

► Economic Dimensions of Transportation

As indicated in chapter 2, remarkably little is understood about transportation as a consumer of economic resources. A joint program of BTS and the Bureau of Economic Analysis to establish a Transportation Satellite Account will for the first time provide effective measures of the full scope of transportation in the economy. The project will also provide robust answers to questions such as: what contribution does transportation make to the cost of specific goods and industries, and how does that contribution vary over time?

A key element in the Transportation Satellite Account is business use of motor vehicles and aircraft not belonging to for-hire motor carriers or airlines. We know from the TIUS that the total mileage traveled by commodity-carrying trucks is divided roughly equally between trucks belonging to for-hire motor carriers and trucks in other businesses. The TIUS links vehicle activity of trucks, vans, and mini-vans to specific types of industries. There are no equivalent data to identify the number of automobiles, sta-

tion wagons, and buses used in either for-hire transportation or other business use, nor how much activity can be attributed to each type of industry. Similarly, there is relatively little information about industry-specific use of corporate aircraft and other forms of general aviation. Data on motor vehicles can be obtained by expanding the TIUS to include automobiles, station wagons, and buses. Surveys of general aviation by the Federal Aviation Administration also, in theory, could be expanded to measure business use of aircraft by type of business. The resulting data on physical use could then be used to estimate the economic consumption of motor vehicles and general aviation that is otherwise underrepresented in the input-output tables that describe the structure of the national economy.

While progress is being made on understanding transportation as a consumer of economic resources, significant uncertainty remains about transportation as an enabler of economic activity and a contributor to economic growth. Part II of the *Transportation Statistics Annual Report 1995* included an extensive review of the current knowledge and identified areas for further research to answer questions such as:

- How can the output of transportation be measured in a way that reveals whether inputs of labor and capital are being used efficiently? Is it possible to control for changes in the quality of transportation output when productivity is measured over time?
- How can the capital stock of transportation be measured to determine the value of investments and whether that value is being maintained over time?
- How many jobs are created by expenditures for construction by mode of transportation and type of project?
- How much does transportation spending contribute to national economic growth? Does the type of spending matter? Do restrictions on transportation affect national economic growth?
- How much do transportation spending and regulation affect regional economic growth? Can growth be channeled in areas of need or away from areas where growth is not desired?

► Unintended Consequences of Transportation: Safety, Energy Use, and the Environment

Chapters 3 and 4 of this report highlight the current state of knowledge on safety and energy consumption aspects of transportation, while Part II features the environmental consequences of transportation. A common theme of these diverse safety, energy, and environmental subjects is the critical need for robust estimates of the size of the vehicle fleet and the amount of vehicle travel and ton- and passenger-miles by mode. Other data needs include:

- Measures of in-use fuel economy by type and age of highway vehicles. Since the Department of Energy's Residential Transportation Energy Consumption Survey stopped collecting gasoline diary data, there have been no statistics on in-use fuel economy.
- The composition of gasoline sold in the United States (i.e., the proportion of nonpetroleum components, especially alcohols, ethers, and oxygenates, in gasoline).
- A national inventory of land used for transportation infrastructure by type of infrastructure and type of land (e.g., agricultural lands and wetlands).
- Methods to assess transportation's indirect land-use impacts.
- Some measure of the accuracy of emissions statistics, and a method of breaking out transportation and nontransportation (e.g., chain saws and lawnmowers) mobile sources.
- Estimates of noise generation and affected population on a national scale.
- An assessment of the road dust issue. Are roads really the major source of fine particu-

lates? Is road dust the major source of human exposure to fine particulates? How do the impacts of road dust vary depending on its constituents?

- Measures of habitat impacts, such as habitat fragmentation and destruction, and noise and pollution impacts, at a national scale.
- National assessments of water quality impacts of transportation facilities. This would primarily include runoff from roads and other infrastructure, and groundwater.

The BTS Program for Meeting Statistical Needs

BTS and its partners are working on a wide range of data-collection, analysis, and dissemination activities to help answer the many questions of decisionmakers. The Bureau's major partners include its sister operating administrations in the Department of Transportation; other federal agencies concerned with transportation, statistics, and geographic data; and several private sector organizations.

The Bureau's major data-collection efforts to date are the ATS, the CFS, and the Surface Transborder Freight Data program. These efforts, all conducted through the Bureau of the Census, provide basic data on who and what moves among domestic origins and destinations and across the nation's borders. BTS will update the ATS and the CFS every five years, and expand the monthly Surface Transborder Freight Data program to establish a more complete picture of the domestic transportation of international trade. BTS will also supplement other parts of the quinquennial Economic Census to measure the relationships between vehicle activity and the economy.

BTS is expanding its analytical efforts from the *Transportation Statistics Annual Report* to special studies of transportation activity and of the relationships between transportation and the economy. Transportation activity studies include analyses of the data generated by the ATS, the CFS, and the Surface Transborder Freight Data program, in particular to relate those data to other programs such as the Nationwide Personal Transportation Survey, the decennial census, Waterborne Commerce of the United States, and the Rail Waybill Data. With respect to the economy, BTS has initiated a joint effort with the Bureau of Economic Analysis to establish a Transportation Satellite Account.

Providing the transportation community with ready access to authoritative and accurate information about transportation is a key part of the Bureau's mission. Its program is designed to meet continuing growth in demand for products and services within an environment of constrained resources. In its first three years, BTS created and distributed over 100,000 CD-ROMs, printed reports, maps, and other products to a wide variety of users.

Exploiting the potential of electronic media is an important BTS strategy for efficiently offering an expanded range of services and products to its public and private customer base. For example, the BTS Internet Home Page (www.bts.gov) offers ready access to BTS products and transportation information sources. BTS also makes its information and data from the Department of Transportation and other federal agencies available through CD-ROMs. The recently established Office of Airline Information within BTS sped up the process of releasing quarterly passenger origin-destination data. Airlines on-time performance data by city-pair is now widely available to the public through the Internet.

Demand for the mapping and data integration capabilities of the Bureau's Geographic Information Systems (GIS) Center is also growing. The GIS Center will integrate the results of the Commodity Flow Survey and the American Travel Survey with facility and service data, and

develop new techniques to represent visually the complex flows identified in those surveys. The GIS Center is continuing to expand its data coordination activities to meet the requirements of Executive Order 12906, *Coordination of Geographic Data Acquisition and Access: The National Spatial Data Infrastructure*.

The restructuring of some federal transportation programs have led to reassignment of data-collection responsibilities to other agencies. The Office of Airline Statistics in DOT's Research and Special Programs Administration is now the Office of Airline Information in BTS. The Interstate Commerce Commission (ICC) was terminated at the end of December 1995. ICC's railroad data programs were transferred to a new DOT entity, the Surface Transportation Board. Motor carrier registrations and insurance oversight were transferred to the Federal Highway Administration. The quarterly and annual reporting of financial and operating data by motor carriers was transferred to BTS.

Another Commerce Department entity, the U.S. Travel and Tourism Administration (USTTA), is scheduled for termination in 1996. USTTA administered programs to count air passengers by nationality and measure travel and spending patterns of foreign visitors to the United States through an on-board survey during international flights. Short-term provisions have been made to continue these programs following termination of USTTA, but a longer term solution has not yet been developed.

Institutional uncertainty is not limited to the future of the Bureau's partners. All authorizations for programs under ISTEA—including the core funding of BTS—expire at the end of fiscal year 1997. Debate about reauthorization is occurring at a time when federal-state relationships are being seriously reevaluated. Proposals to transfer more functions to states, localities, and the private sector will not alter the importance of national data programs, such as those run by BTS, to the broad transportation community. Indeed, additional data-collection and analysis programs may be necessary to serve the informational needs of state, local, and private sector decisionmakers more directly. BTS is considering several issues:

- BTS has focused its initial data-collection efforts on large-scale surveys that provide five-year benchmarks. What types of indicators and additional data sources should BTS develop to track monthly or quarterly changes in transportation and to support short-horizon decisionmaking?
- How can BTS expand its efforts to make federal data more relevant and useful to state and local transportation agencies?
- BTS has attempted to serve the transportation community through a small, Washington-based staff relying heavily on the Internet. What other models for the delivery of information and related services should be considered, such as the state data centers sponsored by the Bureau of the Census?
- How can BTS work with the transportation and trade communities to develop new techniques and technology to collect, analyze, and disseminate data?
- How should federal data programs be reorganized as decisionmaking shifts among levels of government and between the public and private sectors? How can reporting burdens on the states, localities, and private sector be reduced without jeopardizing our ability to collect and use information needed to articulate the importance of transportation?

These questions will be explored through the reauthorization process in 1997.

References

Transportation Research Board (TRB). *1992. Data for Decisions: Requirements for National Transportation Policy Making,* Special Report 234. Washington, DC: National Research Council.

U.S. Department of Transportation (USDOT). 1969. *Transportation Information: A Report to the Committee on Appropriations, U.S. House of Representatives, from the Secretary of Transportation.* Washington, DC. May.

U.S. Department of Transportation (USDOT), National Highway Traffic Safety Administration (NHTSA). 1995. *Registered Passenger Cars and Light Trucks,* NHTSA Technical Report 808 235. Washington, DC. February.